OSTEOPLASTIC RESECTION OF THE SKULL,

WITH DESCRIPTION OF A MODIFICATION OF STELLWAGEN'S INSTRUMENT FOR PERFORMING THIS OPERATION.*

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AMONG the notable advances in surgery in recent years, intracranial operations occupy a prominent place. This fact is due largely to the development of the osteoplastic method of exposing the brain and its membranes. Wagner, who has the credit of first performing this operation in 1889 employed the chisel and mallet to cut through the skull. The value of this method of exposing the brain was at once recognized by surgeons, and almost immediately suggestions of new instruments to replace the chisel and mallet in effecting the bone section began to appear, and have continued, at frequent intervals, up to the present time. Without reviewing the discussion as to the relative merits of the original method, and the numerous substitutes that have been recommended, which is now an old story, it may be confidently stated that the chisel and mallet are employed less frequently each year in the operation now under consideration.

At the present time, the rivalry is chiefly between bone-cutting instruments and saws driven by power,—usually electricity,—and certain cutting forceps and instruments manipulated entirely by the hands.

It is not the purpose of this report to open a controversy on the relative merits of these two general methods of procedure. It will be admitted at the outset that each has its well-defined field of usefulness, as have also a number of the different instruments that have been described. Nothing can be more trite than the statement that an instrument that one surgeon will use with facility and satisfaction will be considered wholly inappropriate under identical circumstances by another operator. I have, therefore, no arguments to advance against any of the methods that have been successful in other hands. I desire, merely, to describe an instrument that has been eminently satisfactory to me, and one, I believe, that deserves a trial from those who have not felt satisfied with the methods they have heretofore employed.

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In 1903 Dr. Thomas C. Stellwagen, Jr., of this city, devised an instrument for cutting an osteoplastic flap of the scalp and skull. Shortly thereafter I had the opportunity of assisting Professor J. William White in some cases of osteoplastic resection of the skull in which he used this instrument, and subsequently employed it in two or three cases in my own service. I was surprised at the ease with which the bone flap was cut, and although the instrument accomplished the object for which it was intended it seemed to me susceptible of improvement in certain minor features. The first objection encountered in this limited experience was the severe tax on the pronator and supinator muscles of the forearm, which, being unaccustomed to prolonged efforts of this kind, became very tired, so that it was necessary to rest from time to time. The second objection from my standpoint, was the lack of security of the plate upon which the shaft of the instrument revolved. In spite of every effort I could make it would soon become loose * and had to be held by the fingers of the left hand, or by an assistant, whose hand in the vicinity of the wound, was usually more or less in the way and impeded the progress of the operation. A third objection was the free hemorrhage from the vessels of the scalp while the bone was being cut through. While hemorrhage from a scalp incision is always copious, and requires the application of a large number of hæmostatic forceps, the sweep of this instrument made the use of the forceps impossible and the well-

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* Dr. Stellwagen informs me that he has since adopted the use of wood screws which overcome this difficulty. However, I prefer the modification here described as this instrument has a fewer number of parts and less time is consumed in establishing the central point or base.

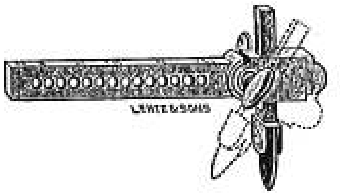
known difficulty of tying the scalp vessels results in a great loss of time. This last objection was overcome to some extent, theoretically, by some operators, by cutting a short segment of the flap at a time, and sawing through the subjacent bone, then enlarging the scalp incision and the bone section, part by part, until the necessary flap was formed. My own observation leads me to say that the total amount of bleeding which occurred when this method was employed was just as great as when the whole flap was cut at once and in addition the time required to change from the knife to the saw and back again, and the extra time required in forming the flap, prolong the operation unnecessarily.

To overcome the first difficulty mentioned, it occurred to me that by attaching a handle to the end of the arm carrying the saw, the force required in cutting the bone could be applied more comfortably, that is, in a way that would be much less tiresome to the operator. This addition to the instrument required the shaft to turn freely upon the handle instead of being fixed as in the original model. Further, as both hands were required to operate the instrument, an effort was made to do away with the base plate which had been a source of inconvenience as already stated.

In my first model all of the features of the Stellwagen instrument were retained. To these were added the handle at the end of the arm, the rotating shaft armed with a spear-pointed pin at the end opposite the handle, which bored a hole in the skull as the shaft rotated, and thus became fixed. A shoulder at the junction of the shaft with the pin prevented the latter from penetrating too deeply and injuring the membranes of the brain. Motion was provided at the joint between the arm and the shaft, otherwise it would be necessary to incline the shaft at various angles, as the saw swept over the irregular surface of the skull, and as it penetrated the bone. In order to combine both ideas in one instrument it was necessary to have means: first, to fix the shaft rigidly to handle; and second, to fix the arm firmly to the shaft,—when used in the original way. To meet the requirements in the other case, both of these points must be freely movable.

Subsequently, the idea of retaining all of the original features was abandoned, as the instrument was thus unnecessarily complicated and further experience with the modified form led me to feel that in the latter, all of the requirements were fully met. An effort was made at first to cut the skull obliquely rather than perpendicularly, in order that, when the operation was completed and the skull flap returned, it would be supported by the bevelled edge of the section and would thus be prevented from becoming displaced inward. With this object in view, in the first model, the clamp at the outer end of the arm in which the saw was secured was arranged so that the latter could be adjusted at any angle desired (see Fig. 1.). After a little experience this feature was omitted, as the perpendicular section is, I believe, in every way satisfactory. The theoretical preference for the formation of a support for the bone flap must be admitted, but I have never observed any tendency of the fragment of bone to become displaced inward, nor do I recall having heard of such a complication.

FIG. 1.



The drill-pointed pin at the end of the shaft which did not give satisfaction was substituted by a blunt pin, and a separate drill was provided.

The various parts of the instrument are shown in Fig. 2, and are as follows:

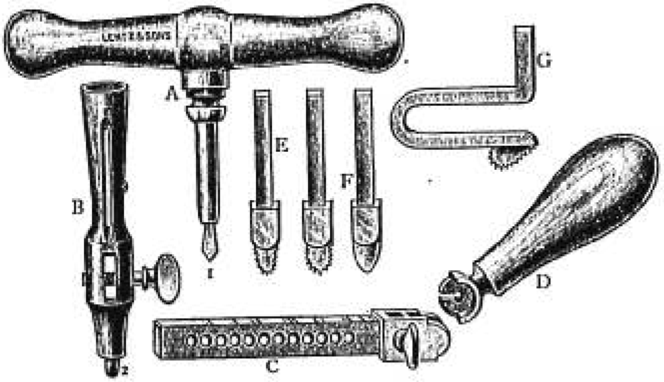
1. A T-handle (A), armed with a bone drill (1).
2. A shaft (B), to which the handle is adjusted, provided

with a fenestra to accommodate the radial arm, and a blunt centre-pin at the end (2). The handle is held to the shaft by a spring, but is instantly released by slight traction.

3. A radial arm (C) which is received in the fenestra in the shaft, and is secured by a thumb screw. The knife and saw are carried at the outer end of this arm and are held by a set screw.

4. A radial arm handle (D), to be adjusted to the extremity of the arm, and used to give the circular motion to the knife and saw. The arm is graduated in inches and centimetres so that it may be instantly adjusted to cut an opening of the desired size.

FIG. 2.



5. Knife and saws (E, F, G).

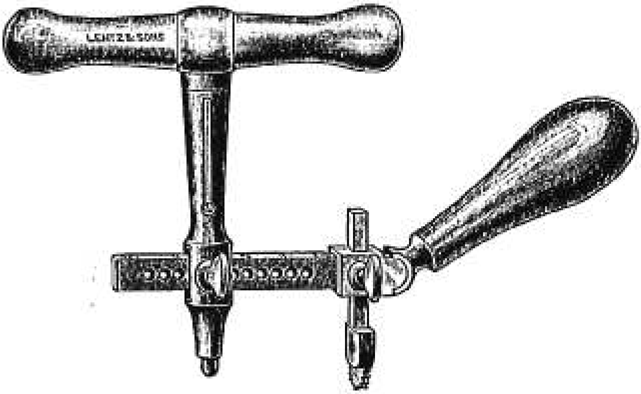
The saw (G) is designed to cut the base of the bone flap by carefully raising the pericranium and scalp along the proposed saw line. The sawing must be done very deliberately in order not to detach the scalp from the body of the bone flap.

Fig. 3 shows the instrument assembled ready for use.

The operation with this instrument is carried out as follows:

The head is prepared in the usual way. The fissure of Rolando, the fissure of Sylvius, or any intracranial landmark desired as a guide at the operation should be marked upon the scalp. After the patient is anæsthetized, important points may be scratched with the point of a scalpel and the entire scalp may again be cleansed with alcohol and bichloride solution. The size of the circle required to expose the area of brain which it is desired to inspect, is determined and the central point marked by scratching an "X" on the scalp with the point of a knife. The radial arm should now be adjusted by the scale to cut a circle of the desired size. When all is ready, a half-inch incision is made in the scalp at the central point (X), the handle, carrying the drill, is then removed from the shaft by slight traction, and a hole bored in the skull at the centre of this incision. The drill is prevented from going through and injuring the membranes by a shoulder. The handle is then replaced in the shaft and the knife inserted in the outer end of the arm where it is secured by the set screw. The T-handle is held in the left hand, the arm handle is applied to the end of the arm and held in the right hand, while the pin at the end of the shaft is introduced into the hole bored in the skull. The scalp flap is now cut, down to the bone, usually by a single sweep of the knife, which should

FIG. 3.

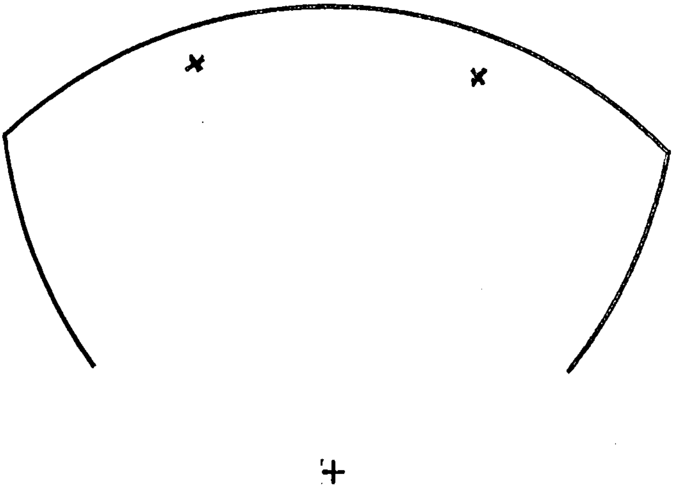


be introduced at the point at which it is desired to begin the incision, and carried around to the point at which it should end, forming two-thirds or three-fourths of a circle. During this manœuvre, as the scalp is freely movable on the skull, an assistant should steady the former and make traction against the pull of the knife, so that the flap shall not be distorted. The knife is then replaced by the saw and the bone cut by moving the saw forward and backward by means of the handle held in the right hand. The saw may be made to traverse the entire length of the incision in either direction with one sweep, but it will usually be found more convenient to cover about one-half of this distance. The saw is so constructed that it cuts equally well in either direction; it is guarded by a shoulder, the blade is scant 3/16 inch long so that it may be used freely without danger of wounding the dura. If the skull is unusually thick at any point the saw may fail to cut entirely through, but no difficulty will be found in prying up the bone flap if two narrow chisels be employed. If the bone has not been cut entirely through at any point, a little edge will be left, which may be cut away with rongeur forceps, or may be allowed to remain to support the flap when it is returned. This support may always be obtained, if desired, by leaving one or more points where the inner table is not entirely sawed through. After the bone section is complete, the base may be sawed through (under the dura) or the bone may be pried up by two chisels, thus breaking the base of the bone flap. No special comment is needed as to the incision in the dura, which is made according to the usual rules.

Two points in connection with the use of the instrument require special mention. First, in placing the radial arm in the shaft, be particular to see that the proper face is uppermost, otherwise the arm handle cannot be adjusted. Second, when sawing the bone, the shaft should be kept perpendicular to the skull, for, if inclined, the saw will be carried in the same direction. After a groove has been cut in the skull, if the saw does not tend to follow this track it will be because the position of the handle has changed. A very little manipulation will again bring the saw in its proper position.

If a larger exposure of the brain is desired than is afforded by the circular flap a somewhat rectangular flap may be made by cutting the segments of three circles of the required size. Fig. 4 illustrates this idea. The "X's" indicate the three centre points used to form this flap. Many variations in size and shape are possible.

FIG. 4.



I have employed this instrument in a number of cases with very great satisfaction. Its use does not tire the muscles at all, it is easily manipulated by any one, it is absolutely safe, and it cuts rapidly. The whole time required to expose the brain has not been observed, but in a number of instances the time has been taken from the moment I began to saw the bone until the flap of scalp and bone was turned up and the dura exposed. The longest period required was eight minutes, and the shortest, one minute and fifty seconds. The latter was in a man about 35 years of age, the flap being three and one-half inches in diameter. With a little practice this part of the operation should be done easily in from three to four minutes, the hole for the centre pin may be made in from one-half to one minute and the scalp should be cut in a minute. Thus in the absence of complications the whole operation of opening the skull need not consume more than from five to six minutes. The very short time consumed in the operation results in a marked decrease in the amount of blood lost, and as soon as the flap is raised forceps may be applied or other measures adopted to prevent further hemorrhage from the scalp wound.

Among those for whom I have operated, and who have witnessed the use of this instrument are: Drs. Charles K. Mills, William G. Spiller, M. Howard Fussell, Charles S. Potts, T. H. Weisenberg, J. H. W. Rhein and S. Ross Crothers.

I believe the following claims may be made for this instrument.

1. It enables one to cut an osteoplastic flap of the skull quickly and safely.
2. No injury can possibly be done. The careless or clumsy use of the instrument can do no harm.
3. Every part may be sterilized by boiling.
4. It is always ready for use as there are no complicated parts to get out of order.
5. It is complete in itself and does not depend upon electric currents, motors, assistants, or anything but the hands of the operator.